

DEMOCRATIC REPUBLIC OF CONGO

CASSAVA SUB-SECTOR ANALYSIS – DRAFT FIELD SURVEY REPORT

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Table of Contents

Executive Summary	2
PART I SUB-SECTOR REVIEW	7
Introduction.....	7
Cassava Production in Africa.....	7
Cassava Production Trends in the East and Central Africa Region.....	8
Sub-sector Advances and Constraints in the Region	10
WHY SUB-SECTOR ANALYSIS	12
APPROACH	13
CASSAVA RESEARCH AND PRODUCTION IN DRC .. Error! Bookmark not defined.	
Introduction.....	15
CASSAVA RESEARCH AND TECHNOLOGY TRANSFER	15
The Main Limiting Constraints in Research.....	17
PRODUCTION OF CASSAVA IN DR-CONGO.....	18
Farming Systems.....	18
Cassava Production Levels	19
Production Constraints.....	22
MARKETING	23
Marketing Chain for Chikwangwe, Cossette and Raw Cassava Roots	25
Marketing Constraints.....	25
PROCESSING.....	25
Constraints in Processing.....	27
UTILIZATION	27
Potential Areas for Cassava Utilization	29
Industrial Uses of Cassava.....	29
STAKEHOLDER ANALYSIS.....	30
Fig 10 Stakeholder Participation In Various Components of the Cassava Sub-sector In DRC	32
POLICY ENVIRONMENT	33
Technology Environment.....	34
PART II SURVEY RESULTS	36
Methodology.....	36
Field Data Collection	37
RESULTS AND DISCUSSIONS.....	37
Production	37
Farming Systems.....	38
Main Constraints.....	40
Opportunities.....	40
PROCESSING.....	40
Main Processed Products	41
Consumer Preference for Processed Products	41
Constraints in The Cassava Processing.....	41
Opportunities.....	41

Processing at Household Level.....	42
CASSAVA MARKETING IN DRC.....	42
Main constraints Facing Traders	43
Transportation	43
UTILIZATION.....	43
Human Utilization.....	43
Utilization of Cassava As Animal Feed.....	44
Industrial Utilization of Cassava.....	45
CONSLUSION AND RECOMMENDATIONS	45
Specific Recommendations.....	46
REFERENCES.....	47

LIST OF ACRONYMS

DRC	Democratic Republic of Congo
SNV	Service National Vulgarization
EARRNET	East Africa Root crops Research Network
ACMD	Africa Cassava Mosaic Disease
CMB	Cassava Mealy Bug
CGM	Cassava Green Mite
IITA	International Institute of Tropical Agriculture
FAO	Food Agriculture Organization of United Nations
Ha	Hectare
Kg	Kilogram

EXECUTIVE SUMMARY

This report presents information on the current status of the cassava sub-sector in Democratic Republic of Congo (DRC). It is based on information gathered through literature review and key informant interviews with stakeholders and researchers in DRC. The purpose of the sub-sector review is to gain an understanding of what is the status of the cassava industry in the country in order to identify; information gaps (areas that need further investigation), constraints in the sub-sector, opportunities for immediate investment and research programming, technological and policy environment in which the sub-sector operates. The report also provides a stakeholder analysis and how the different stakeholders have collaborated in the development of the sub-sector.

This study is part of a region wide sub-sector analysis for all the EARRNET member countries (Kenya, Uganda, Madagascar, Rwanda, Burundi and DR-Congo). It is being undertaken in collaboration of National Cassava programmes.

The objectives of the study are;

- Review and update available information on the sub-sector in consultation with sub-sector stakeholders to provide valid, reliable and timely benchmark information on cassava production to consumption system for effective implementation of EARRNET activities,
- Study the various components of the Production to Consumption System (PCS), identify constraints, assess needs, determine areas of technological, institutional, organizational and policy opportunities and purpose interventions to enhance food security, income generation and socio-economic growth and development,
- Propose research development programmes, coordinate introductions, adaptation, development and dissemination of end-user preferred market oriented technologies for a more efficient and equitable sub-sector,
- Highlight access, equity, sustainability and gender issues for technical options, assess costs and returns of technologies (existing and new) and the potential for increased cassava trade through increased production, utilization and commercialization.

Cassava is the staple food for the majority of DRC population. The roots and the leaves are both consumed and have almost equal importance in the population diet. Production levels of cassava are estimated at 16.5 million tons from a total area of 2 million hectares (SNSA, 2000). The leading cassava producing areas in the country are; It is the main staple food in the Southern parts of the country. Annual production is estimated at 2.4 million tons under an estimated acreage of 358,000 ha. (FAOSTAT, Web2000). Cassava is a principle crop in all the regions except, North West and Southern Highlands.

Cassava is principally a smallholder crop and is grown as an intercrop with other main food crops. Some mono-cropping is also done but mainly on a large scale.

The main constraints facing production are; the cassava mosaic disease, lack of clean planting material, and poor agronomic practices. Post-harvest technologies are also a limiting factor in cassava production. These include, storage, drying and processing techniques. Labour intensive processing methods using traditional skills are the most dominant and there is need for more efficient (less time and labour) consuming methods.

Processing and packaging technologies for export cassava leaves are not documented. The level of trade in cassava leaves is also undocumented, and this relationship needs to be established as it has bearing on root yields.

INERA's Mvuasi station is researching on uses of cassava in bread baking using cassava/wheat composite flour.

Cassava is marketed in various forms in DRC, including raw roots, raw cassava leaves, cossette (dried chips), cassava flour and chikwangwe. There are various levels of trading including, farm-gate sales, village markets assembling, wholesaling in major urban centers especially Kinshasa and retailing. The most vibrant is that of retailing of various cassava based products, of which the leading are chips, chikwangwe and leaves. The nature and level of marketing is largely undocumented.

Although there were a limited range of products in which cassava is used in the country its level of use is beyond that of any other country in the EARRNET region. Efforts should be made to widen the range of products in which cassava is used.

In the area of stakeholder collaboration, the FAOR has initiated a cassava working group in the country which brings together, INERA researchers, other development agents with interest in cassava, producers and manufacturers of cassava based products. This group is an important step towards charting out a development agenda for the sub-sector which appears to be threatened by disease pandemic and lack of clean planting material.

Areas that need immediate investigation include the extend of the devastating effect of the cassava mosaic disease in the main cassava growing areas, the importance and level of use of cassava leaves and how this affects technology adoption and yield of cassava roots, analysis of the marketing structure of cassava and cassava based products, level of use of cassava in the industrial sector and the potential for expanding its use, and potential for commercializing multiplication and distribution of planting material. The level of decline of cassava production, while that of competing maize shows some slight increase should also be investigated, to gain an understanding as to whether consumers are switching their preference to maize. COSCA reports indicated that consumption levels in major urban centers with access to wheat and rice were low compared to areas that had no easy access to the cereals.

The primary survey results indicate that cassava is still an important food crop in the country. The survey involved interviews with 161 randomly selected farmers in Bandundu, Kinshasa and Bas Congo provinces, 95 randomly selected traders, 29 purposively selected processors, 12 purposively selected transporters and 13 purposively selected input/service suppliers in the cassava trading chain. Traders were used to capture consumer information. This information was complemented with that collected at household level.

The survey findings indicate cassava is an important food crop in Burundi. It is third in importance after bananas and sweet potato. Both cassava tubers and leaves are important for household diets in the country.

From the survey reports cassava was intercropped with maize, beans and bananas. It was also grown as mono-crop. The survey revealed that the most important cassava varieties in the country were, F100, Mvuama, Kinkogolo, Muzesu and Nsubakani. The level of importance of varieties was not as extreme as in Burundi. In DRC the highest preferred variety, F100 was only rated as the most important variety by 6.7% of the surveyed households. The main reason for appreciation of variety was yield followed by taste.

Cassava is used mainly for human consumption although some farmers claimed they also fed cassava to livestock.

In terms of processing, most of the processing of cassava in the country is done at the household level using simple traditional technologies. The most important processed products in the country were flours, chikwaunge, cassava chips (cosettes).

The main constraints facing cassava production in the country from the survey results include; diseases and pests, lack of planting material, poor infrastructure (roads, transport and market facilities), high taxes, theft and insecurity.

Cassava marketing is affected by lack of appropriate market infrastructure, market information and high taxes. The quality of the marketed products is also a problem as there does not exist quality standards for the processed products. Traders also complaint of irregular supplies of processed cassava products.

Cassava utilization is affected by lack of nutritional information on cassava, narrow range of processed edible products and irregular supplies of cassava products in the market.

The country does not have an established industrial base for cassava. Thus the main promising avenue for cassava in the country lies in promoting it as a food security crop.

It is recommended that efforts be made to address the key problems identified in this study. These include;

At research Level there is need to continue research and dissemination of improved varieties that are early maturing, and resistant to diseases and pests.

Production: Cassava is the most important food crop in DRC. It would continue to be an important food crop in the country in the face of continuing food shortages caused by a number of factors. Production of the crop is limited by a number of factors, of which the most important ones are, diseases and pests, shortage of planting material, civil strife, and poor infrastructure.

Processing: Improved processing techniques for cassava tubers into chips and efficient drying techniques of the chips. Here efficiency refers to faster drying methods that can reduce moisture to acceptable levels.

Support the medium and small-scale millers to improve the quality of their processed products to consumer preferred standards.

Research into and diversify the range of processed products from cassava. Efforts being made by INERA to process cassava into baked products need to be stepped up and must involve the relevant private sector players such as flour millers and bakeries.

Marketing: although cassava products are important tradable commodities in DRC, a number of factors affect the returns to the traders. These include poor marketing and storage infrastructure, insecurity along the highways, high transport costs and poor highways and transport systems. Numerous tax points between the source of the commodities and the final selling point.

Utilization: Unlike some of the other countries in the region where cassava is being used in animal feeds and in some places as industrial raw material, cassava in DRC is largely used for household consumption. There was little evidence of use of the commodity in animal feeds and none in the industrial sector. Since the country is still facing food shortages, it appears cassava would still continue to play its role in household food security in the near future.

Policy and Stakeholder Collaboration: There is no specific policy in the country at the moment on the promotion of cassava either as a food crop or industrial crop. Some policy intentions can be gleaned from the country's commitment to research and promote improved technologies for promoting. Continued government support for the cassava research with and generous donor input is also an indication of policy commitment to improve the production of the crop. The FAO led cassava working group though working without any formal mandate is an indication of national importance of the cassava crop.

The country however, needs to come out with a well spelled out policy statement on the development of the sub-sector. Important points should be on research support, post-harvest technology development and transfer and removal of all barriers that hinder or discourage trade in the commodity.

The collaborative work of the cassava working group can be formalized and given mandate and targets of desirable achievements. It should also be mandated to be an advisory body for the development of the sub-sector at all levels. The private sector should also be incorporated into the group so that their views can also be considered in all development strategies.

Opportunities in the Sub-sector: Cassava should be given priority as a food security crop in the country. To achieve this goal a number of factors need to be addressed. First, is the issue of availability of planting material of early maturing and disease resistant and of high yielding. The ACMD has already devastated the production of cassava in the country based on reports from IITA scientists and national production statistics which show the crop has declined steadily from about 19 million tons in 1991 to about 16 million tons in 2000. Most this decline can be attributed to ACMD and also civil strife which has led to displacement of a number of farmers. This calls for intensive research and multiplication and distribution of planting material. Since the organizations currently involved in multiplication and distribution of planting material do not have adequate capacity to reach all farmers, it is suggested that a study on a community based seed multiplication and distribution system in the country be undertaken to identify and recommend a viable model for seed multiplication and distribution.

Improving the marketing of the commodity will also ensure that farmers can dispose any surplus produce and generate necessary income for other household needs. This will motivate farmers to increase production through increased acreage and yields.

The use of cassava in industrial food processing in the country should also be explored. The immediate target could be large-scale flour millers. If the millers are convinced and start large scale milling of wheat/cassava composite flour, it would be easy to convince the bakery industry to use such flours as long as acceptable standards are formulated.

PART I SUB-SECTOR REVIEW

Introduction

Cassava (*manihot esculenta*) was introduced to West and Central Africa from South America by the Portuguese more than 400 years ago. It is now grown throughout sub-Saharan Africa and is considered second in importance to maize as a human staple, accounting for more than 200 calories per day per person. Estimates show that about 160 million people or 40 per cent of the population of sub-Saharan Africa consume cassava as a staple food (Nweke et al. 1988).

Whereas in South America and Thailand cassava is increasing being grown for industrial use, in Africa it is largely grown for human consumption. World production is estimated at million tons of which Africa produces about

Cassava Production in Africa

Cassava is today one of the dominant starchy staples in the diet of people in Sub-Saharan Africa. Although it is grown in every country its cultivation is concentrated in humid tropics.

Africa's production of cassava is projected to grow at 2.9 per cent per year, which will raise production to 114 million tons by the year 2005. The bulk of the increase is expected to come from the Democratic Republic of Congo (DRC), Ghana, Madagascar, Mozambique, Nigeria, Tanzania and Uganda. Demand for direct consumption is expected to reach 85 million tons in the year 2005 with a growth rate of 2.8 per cent. In Table 1 below production estimates for Africa in the last decade are presented. The data shows a steady increase in production, from 79.35 million tons in 1991 to an estimated 92.12 million tons in 1999. The increase is attributable to increase in area under the crop and also improved yields per hectare.

Table 1 Production of Cassava in Africa 1991 – 1999 in MT of Fresh Tuber Equivalent

Year	Area (Ha)	Production (MT)	Yield (Kgs/Ha)
1991	9,882,080	79,348,242	8,030
1992	10,163,363	81,868,845	8,055
1993	10,044,132	82,678,292	8,232
1994	10,323,385	83,816,343	8,119
1995	10,467,699	85,192,286	8,139
1996	10,225,193	84,587,126	8,272
1997	10,117,313	84,760,847	8,378
1998	10,797,101	90,013,262	8,337

1999*	10,823,616	92,119,233	8,511
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Source: FAOSTAT Web2000.

Note:* Estimate

With increasing demand for cassava following due to; population growth, changes in food preferences and increase in industrial needs in the continent, sub-sector operators will be confronted with the challenge of increasing production, improving access to good quality cassava products and expanding markets, which will contribute to local, national and regional food security and socio-economic growth.

The use of cassava for animal feeds in the continent is expected to grow at an annual rate of 1.3 per cent to the year 2005 largely due to expansion of processing facilities to meet any potential growth in domestic and export markets. Other uses of cassava (e.g. starch etc.) in Africa are expected to rise at even higher rates: 5 per cent in Benin, Ghana, Kenya, Zambia and Zimbabwe.

Some of the limiting factors for increased cassava production in Africa are:

- Unreliability of supply;
- Uneven quality of products;
- Low producer prices;
- Lack of appropriate storage technologies;
- Labour intensive processing techniques, and;
- Costly marketing structures.

Cassava Production Trends in the East and Central Africa Region

Agriculture is the most important economic sector of the Eastern and Central Africa countries. It provides livelihood to about 80% of the population in the region; it is the main foreign exchange earner, provides the highest proportion of employment and is the main source of raw material for the largely agro-industrial sector in the region.

Cassava production in the region is estimated at about 24 million metric tones from a combined area of about 3.1 million hectares. Of this DRC produces about 16.5 million tones from an estimated area of 2.1 million hectares.

The production levels of cassava in five EARRNET countries are presented in figure 1. In this figure, DRC production has been omitted because of scaling. DRC's production is about four times that of Uganda. As it can be seen, Rwanda has recorded the lowest level of production in the last 10 years. Of all the countries shown, Uganda is the only country that has shown a significant increase in production after 1997.

Most of the decline in production within the EARRNET countries experienced from 1991 to 1996 has been attributed to cassava mosaic disease impact and civil strife experienced in most of the main producing countries.

The spread of cassava mosaic disease in the lake region was reported in ASARECA's AgriForum in the April 1998. The disease had first been recorded in Uganda in 1989. It spread into western Kenya in 1995, Southern Sudan in 1997 and in DRC in 1998 (ASARECA-Agriforum, April 1999). The mosaic virus has spared none of the countries in the region. Other contributing factors to the decline in production are lack of clean planting material caused by limited capacity to multiply and distribute improved planting cuttings.

In response to this pandemic, a number of programmes mainly donor funded have been initiated in the region to address the cassava mosaic problem and support multiplication and distribution of clean planting material. The East Africa Root crops Research Network (EARRNET) was started in 1993 and its mandate has been in the area of germplasm development, breeding and support for technology development and transfer in the region.

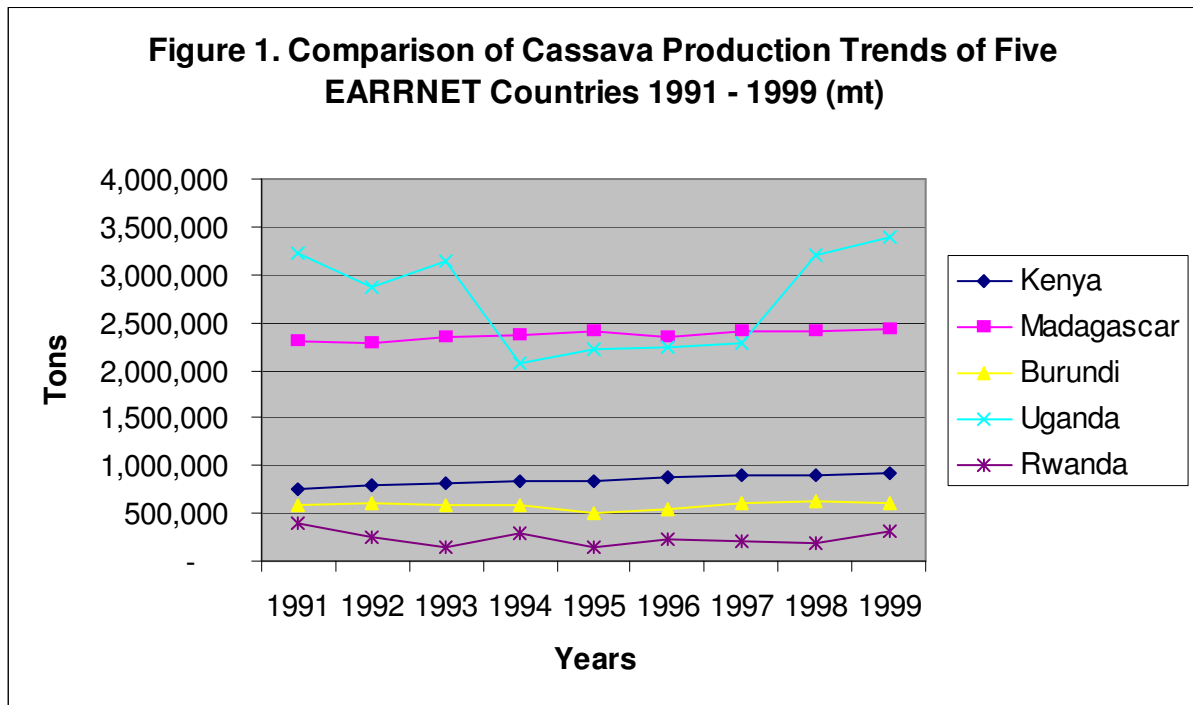
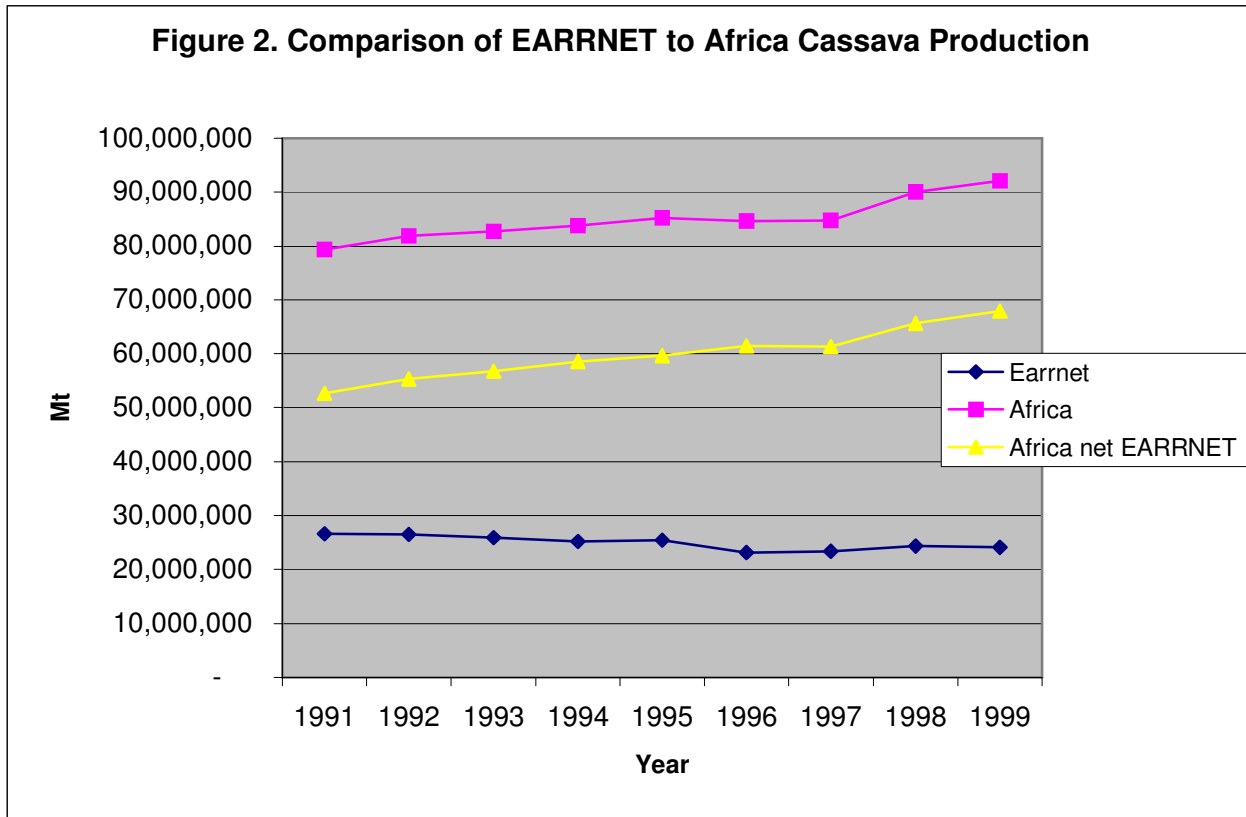


Figure 1 above demonstrates the commodity's vulnerability to pandemics as it happened in Uganda during 1993 – 1997, when the cassava mosaic struck. As it can be seen, between 1993 and 1997 there was a major drop in production of cassava in Uganda associated mainly to cassava mosaic disease.

In figure 2 below a comparison of cassava production in the EARRNET region to that of the entire continent is presented. As it can be seen, the region is an important cassava producer in the continent. However, production levels in the region have declined

marginally in the last decade largely due to cassava mosaic disease. The overall production in the continent has however increased within the same period from 80 million tons in 1991 to an estimated 92 million tons in 1998. The gains in production in the continent can be attributed to research advances in Western Africa in which most diseases and pests have been controlled and adoption of improved planting material has been significant.



The increase in production in the continent can be attributed to advances in improved production techniques and varieties in Western Africa countries.

Sub-sector Advances and Constraints in the Region

EARRNET is one of the networks of ASARECA. It is charged with spearheading the development of the cassava sub-sector in the region in order to contribute to food self sufficiency and socio-economic development. To achieve this goal the network promotes production, utilization and commercialization of cassava through development of suitable and acceptable technologies for use by the different stakeholders. Its technology development and transfer mission falls under four categories; research, training, information exchange and institutional capacity building.

EARRNET works through national research systems and in collaboration with other international research agencies from which it is able to tap current research breakthroughs, achievements and lessons from other parts of the world for the benefit of

the regional cassava programmes. This places the network in a unique position to help in solving most of the problems affecting cassava production and utilization in individual member countries, including pandemics.

Since its inception, the network has worked towards identification of cassava production and utilization constraints and developed approaches to mitigate against them. The African cassava mosaic disease (ACMD), limitation of post-harvest technologies and marketing constraints have been some of the major daunting challenges facing the network. The ACMD has been tackled through development and transfer of mosaic resistant varieties. In this area a new challenge of multiplication and distribution of clean material has also emerged, as the national research institutions do not have the capacity for multiplication and distribution of planting material. The national programmes have tried to address this problem through collaboration with other development agencies within their respective countries.

In the area of post-harvest technologies, processing and storage technologies have posed the biggest challenge. In almost all the network countries cassava is mainly processed using traditional methods. These methods are costly in terms of time, labour and wastage. The quality control of the resulting products is also problematic. The low level of technology also implies that the number of products processed from cassava is also limited at the national level. Storage is a big problem because cassava is highly perishable. To increase cassava shelf life, it has to be processed such that its moisture content is minimized. The available technologies have serious limitations in this area.

Commercialization of cassava in the region is limited. In majority of the countries the share of sales out of the total production rarely exceeds 15%. This means the crop is largely grown for food security reasons. In rare occasions the crop is grown for commercial purposes, such as in the DRC where the leading flour miller has a nucleus estate of cassava from which it grows cassava for milling.

The potential for cassava to contribute to food security in the region is enormous as most of the countries continue to register food deficits and reliance on food relief from international agencies. Opportunities exist to expand production through increase in acreage and improvement in yields. Within the region cassava is primarily a food crop, being a main staple in DRC, second important food staple in Uganda and Madagascar and third important staple in Rwanda and Burundi. In Kenya the crop is an important staple food in the western and coastal areas of the country.

Cassava use in industrial processes is limited in the region but opportunities exist in countries with relatively established industrial base such as Kenya, Uganda and Madagascar. The main industrial potential use of cassava in the region is in livestock feeds, food manufacturing and in paper and textile industries.

Cross border trade in cassava has been reported but not documented between Kenya and Uganda, Rwanda, Uganda and Burundi and between Burundi, Rwanda and DRC. The

main traded commodities are cassava chips, planting cuttings, fresh roots and to some extent cassava leaves.

At the policy level, there is no evidence that any of the network countries have an explicit and clear cut policy for the development of the sub-sector. Only in countries where cassava is a principal food crop such as DRC and Uganda is cassava ranked highly in research. Most countries neither have a food security policy, making it impossible to gauge where cassava ranks at the national policy level.

WHY SUB-SECTOR ANALYSIS

The International Agricultural Research Centres (IARCs) and NARS initiated COSCA in 1989 with the objective of improving the relevance and impact of agricultural research on cassava in order to realize the potential of the crop in raising food production and incomes. The study covered six countries: Cote D'Ivoire, Ghana, Nigeria, Tanzania, Uganda and the DRC. Later it was expanded to cover Benin, Burundi, Cameroon, Kenya, Malawi, Rwanda and Zambia. The study was done in three phases. The first phase broadly characterized the agro-environment (physical, social, and economic), production, processing, marketing, and consumption situation. The second phase dealt in more detail with yield, land area, crop utilization (sale or home use, processed or fresh use), and input/output relationships. The third phase involved detailed studies on post-harvest issues such as characterization of processing techniques, product quality assessment (nutrition, toxicity, and quality), marketing, consumption and demand. In Uganda the three phases of COSCA were implemented.

While the COSCA study provided vital information for decision making, it does not provide comprehensive coverage on the cassava PCS continuum and linkages and how they affect the overall performance of the sub-sector. Key information on participants, processes, functions, and outcomes is also lacking in detail.

The study was also carried out in a period in which reforms in the agriculture sector, foreign exchange and overall macro-economic setups were being implemented in all the countries in the region. Hence the outcomes of the study do not represent a normal scenario, as it was done during a period of change and transition. Policy changes are likely to affect macro-and micro economic setups, and the cassava subsector is no exception.

Political instability in the region, which has threatened food production through displacement of farmers and disruption of economic activities, their effect on research work and the emergence and spread of the cassava mosaic disease in the region have also altered cassava production and utilization in the region. The impact of new technologies on production, processing and utilization of cassava, in the last decade may have altered its position as food and commercial crop.

Changes in weather which have seen an increase in the incidence of erratic rains, resulting into failure of grain crops may have stimulated farmers to give more attention to

cassava which can withstand adverse weather conditions, in order to mitigate the effects of famine.

Since the COSCA study a number of theme specific studies have been carried out in Uganda in response to research, donor and other stakeholder needs and challenges. These studies have generated important information for decision making and programming. However, there is no comprehensive document or documents that presents the overall cassava sub-sector picture in the country at the moment. Consolidating the existing information in form of a comprehensive status report was therefore considered as a first step in understanding what is known about the sub-sector, identifying the key stakeholders, their expectations and motivations and the critical components and linkages within the sub-sector.

There is therefore need to update information on all aspects of the cassava production-to-utilization system, including stakeholder analysis, major constraints and opportunities in the sub-sector and more importantly carry further the COSCA work by identifying opportunities for increasing cassava contribution to food security and industrialization (commercialization) in the region.

This first step of the sub-sector analysis was combined with key stakeholder consultations in order to enrich the published information with the more current activities in the sub-sector. The review and key stakeholder consultative information contained in this report is meant to elicit debate, identify critical constraints and opportunities within the sub-sector to contribute to food security and incomes for the rural and urban poor. The analysis will also identify information gaps within the sub-sector which will be a basis for primary data collection and analysis.

APPROACH

Two EARNNET steering committee review meetings held in Nairobi 23 – 24th June and July 3rd 2000, respectively endorsed the hiring of a consultant to handle the cassava sub-sector study in collaboration with the NARS and other stakeholders. NARS were asked to form cassava task forces comprising the national programme scientists, other cassava project representatives, NGOs, farmer associations, universities, donors, consumers and other interested parties to guide the sub-sector analysis at the national level. The committee agreed to use a production to consumption systems approach (PCSA) in the sub-sector analysis.

The PCSA is an important tool in sub-sector analysis. It focuses on the identification of the different commodity components and their interactions among themselves and with the environment. It is an important tool to focus and steer commodity research, policy and technological interventions intended to improve the overall performance of a commodity sector. Overall commodity performance is finally assessed in terms of its contribution to food security, employment, income and distributional impact within society at the macro level.

Correctly used PCS is directed to identify strategic points and forms of interventions in order to improve the performance of the commodity system. This objective requires the analysis of the current structure and the behaviour of the system and the understanding of the relations of these to its overall performance and environment. This implies a conceptual decomposition of the system into its micro level components, featuring the most influential interest groups, and the interactions of these components with each other and with the environment.

Because of its nature, PCS requires the work of interdisciplinary teams that approach and effectively incorporate the participation of intended final beneficiaries and other users of the expected research results.

Literature review and key stakeholder consultations were carried out in order to consolidate the existing information and complement it with current but unpublished information on the activities in the sub-sector.

A stakeholders' workshop was held to discuss the draft report of the literature review and to identify information gaps within the report and recommend other sources of information that could be used to improve the report. Following the stakeholders meeting, a survey focusing on farm households, traders, processors and transporters of cassava commodities was undertaken. The results from the survey have been consolidated with information from literature review to arrive at this report.

Specific papers have been commissioned within the region to collect and analyse information on key areas that required detailed study. Some of the relevant papers for Burundi include a study on cassava in the wider food systems, potential for commercialization of planting material multiplication and distribution, and necessary policy reforms for cassava to make wider contribution to food security and income generation.

This report identifies opportunities and information gaps for further action by stakeholders and key players in the industry and proposes areas for further research and immediate investments.

A five day regional workshop will be organized to cover reporting of the work done, exchange views and sharing information and ideas on the strategies of expanding the sub-sector and building up a regional sub-sector strategy for cassava. Discussion groups covering production, utilization and marketing will discuss relevant subjects in detail and come up with issues of immediate, medium and long-term concern. Ways and means of circumventing these constraints will be mapped out with specific agenda for action and budget implications. Matters requiring immediate corrections by the stakeholders at no cost for the better performance of the sub-sector will be sought before finalization of the strategy document. This report will form part of the resource material to be presented at workshop.

INTRODUCTION

Cassava Research and Technology Transfer in DRC

Research activities on cassava in the country were started in 1930s, under l'Institut National pour l'Etude Agronomique du Congo Belge (INEAC) at the Yangamba station. In 1974 the government created the National Cassava research Programm (PRONAM). Since 1990, the programme has benefited from technical assistance from IITA. In 1993, the programme was integrated into the national research programme l'NERA.

The objectives of the programme are to;

- Develop improved cassava varieties, that have high yields, are resistant to pests and diseases and adoptable to different ecological zones and processing,
- Develop systems for economic exploitation of cassava products, and
- Transfer of improved technologies to beneficiaries.

Cassava research is ranked very highly by the l'NERA research organization.

INERA through its regional research stations is charged with research on cassava in the country. The focus of the cassava research programme has been on breeding, germplasm development and trials, laboratory tests, training and capacity building, seed multiplication and distribution and technology transfer. The Institute works in collaboration with other national and international development agencies and donors.

About 2000 cassava plants from 200 IITA elite clones were imported into DRC, Mvuazi research station laboratories. There are four laboratories in this station; one dealing with cassava biochemist for cyanogenic potential (CNP) and cassava processing into various products including wheat-cassava composite bread, the second deals with cassava pests using biological control methods, the third is a pathology laboratory backstopping the breeding program in screening for diseases resistance and the fourth is being set up too deal with tissue culture activities.

Agencies that are collaborating with INERA is research include University of Kinshasa, CRENK, Service National Vulgarization (SNV), Service National de Semences (SENASA) and IITA.

In the area of technology transfer there are a number of agencies are that are involved mainly in planting material multiplication and distribution, they include NGOs (CADIM, FOLECO, Red Cross and APPRODEC), donor agencies (FAO, UNDP, GTZ and Belgium Cooperation Agency). There is some level of collaboration between some of the agencies but it is largely undocumented or informal.

Some of the varieties that have been released are listed below

Table 2. Varieties Released By INERA

Variety	Year of Release	Months to Maturity	Yield (mt/ha) RST/farm	Suitable Ecology zone	Dry Matter %
Kinuani (bitter)	1981	9	20/10	Clay soils (Bas-Congo)	30
F100 (sweet)	1984	12	20/10	General	40
Pululu (sweet)	1987	12	20/15	Clay/sandy Bas-congo, Kinshasa, not suitable in forest areas	40
Tshilobo (bitter)	1984	12	20/10	Kasai	30
RAV (sweet)	1997	12	30/15	General	35
Sadisa (bitter)	2000	12	30/	Sandy/clay Bas-Congo, Kinshasa	35
Papayi (very sweet)	2000	12	25/	Clay	40
Mvuama (bitter)	1996	15	20/13	Clay (Kinshasa, Bas-Congo)	38

Source: Interviews with PRONAM researchers.

The level of well trained personnel researching on cassava is quite limited considering that, the crop is a major source of livelihood in the country and the main biological and biophysical challenges facing it at the moment. As it can be seen in table 3 below, there is currently no personnel trained at the PhD level in PRONAM.

Table 3 PRONAM Human Research Capacity

	1985	1990	1994	2000
PhD	2	2	1	0
MSc.	6	3	4	3
BSc.	0	4	1	1
Technical	5	6	4	5

Source: Interviews with PRONAM research team.

A number of institutions are currently funding research and technology transfer activities in the country. The leading ones are IITA/EARRNET, the Government, and FAO. Most of the funded activities include;

IITA: Cassava green mite project and Cassava flour fortification

EARRNET: germplasm development, root scale disease, cassava flour fortification, chikwngue fortification and IPM for cassava green mite and cassava meal bug.

DRC-Government: General Research and Extension and

FAO: Seed multiplication and distribution

The Main Limiting Constraints in Research

- Low level of funding
- Limited human resources (number and level of training)
- Inadequate Research facilities (libraries, laboratories, motor vehicles, communication)
- Low level of incentives to research personnel leading to high turnover.

PRODUCTION OF CASSAVA IN DR-CONGO

DRC is the main cassava producer within the EARRNET countries. Although cassava is produced in all parts of the country, the major five producing provinces in the country in order of volume of production are; Bandundu, Oriental, Katanga, Equateur, and Bas-Congo. Each of the five provinces produce more than 1.5 tons of cassava per annum based on 1996 statistics.

DRC is the second largest producer of Cassava in Africa, with a current estimated output of about 16.5 million tons of cassava roots. The level of production of cassava leaves which is equally important is however not documented.

Farming Systems

COSCA study showed that about 70% of the fields visited were grown with cassava while, 13% were planted with maize, beans and peas (Nweke et al, 2000). Although this finding could be disputed on the basis that sampling was biased towards farms in the major cassava growing areas, evidence from other data shows that the area and production levels of cassava are much high than any other food crop in the country. As shown in figure 1 and 2 below in 1999 16.5 million tons of cassava were produced compared to only 1.24 million tons of plantains its closed rival. In fact the level of cassava production is higher than of all other food crops combined.

Cassava is not grown on a continuous basis like other annual crops because of its long growth cycle relative to the other crops.

The study also found planting material to be a major problem across the surveyed fields. Farmers were selecting their own genotypes based on canopy, early bulking, and those with good under ground storability (Nweke, et al, 2000).

Available landraces had low genetic potential for root yield as most were susceptible to plant pests and diseases especially ACMD.

Agronomic practices for cassava in DRC:

- Crop rotation
- Fallow management
- Planting material selection
- Generally grown as intercrop
- Can be planted late into the rain season as it is hardy
- Planting can be spread over several months
- Harvesting rarely done at once.

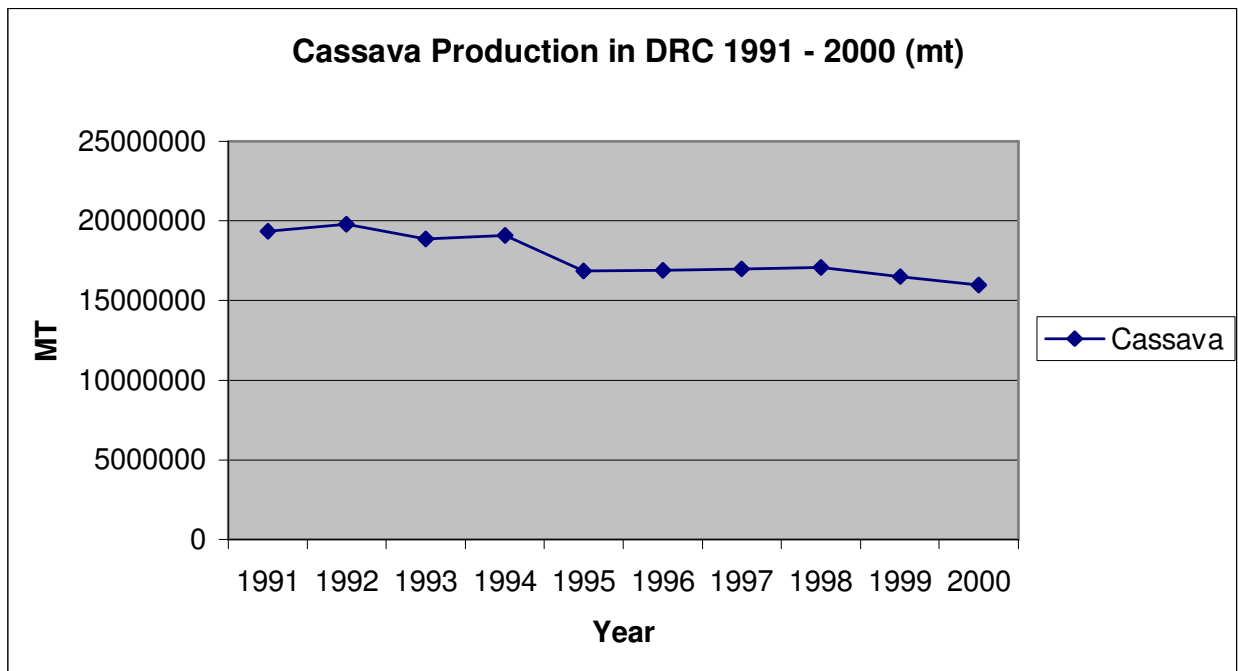
In terms of varietal characteristics it was found the bitter type of cassava comprised 60% of the planted cassava. Farmers use planting material from their own farms or from neighbours. In selecting planting material they consider; weed susceptibility, early bulking, branching characteristics, good in-ground storability, pests and diseases resistance and good processing qualities.

Low branching is desired for weed control but not for intercropping, while high or no branching is desired for intercropping and not weed control.

Cassava Production Levels

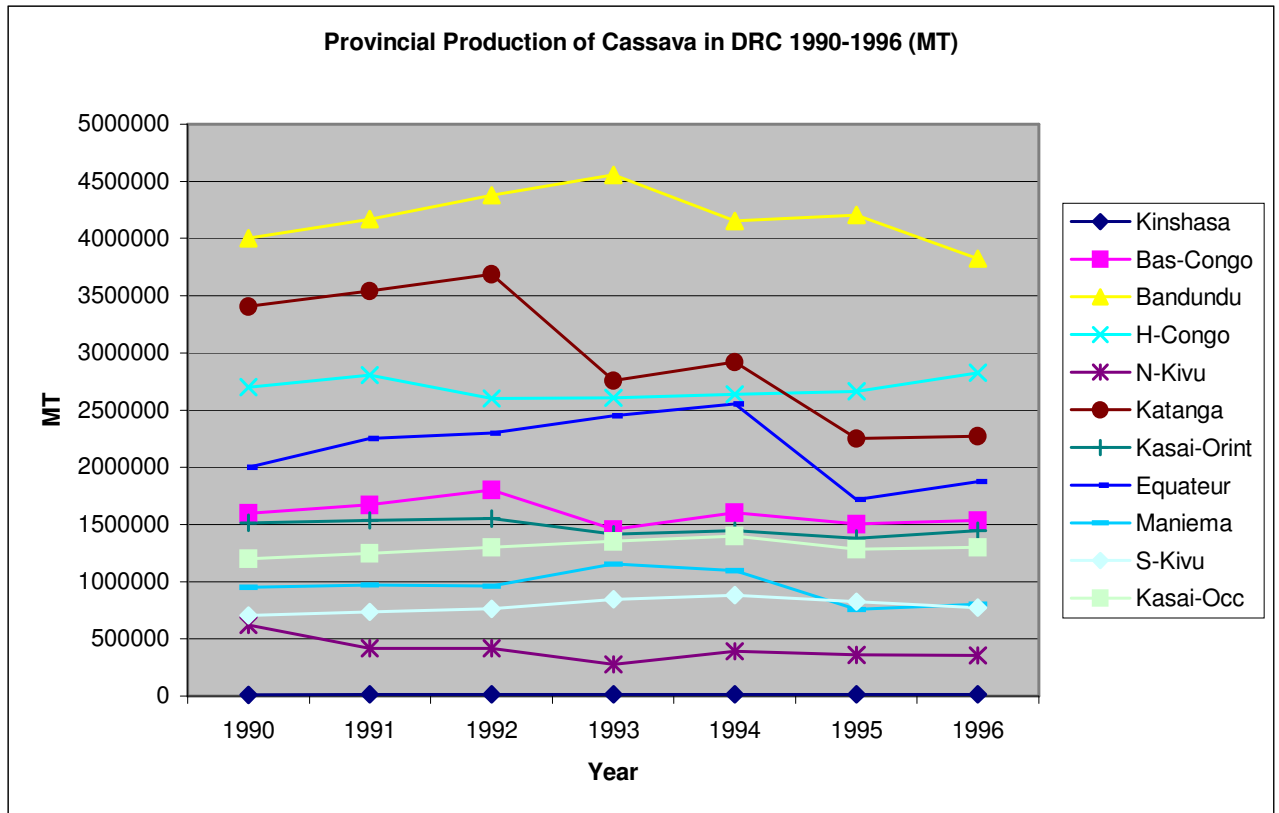
The production of cassava in the country shows a steady decline since 1992. although a number of reasons could be attributed to this decline the principal ones are civil strife and the cassava mosaic disease. As indicated in figure 3 below the area under the crop has also declined in the same period. In the figure below the level of cassava production is shown for 1991 – 2000. This production only represents cassava roots and not leaves.

Figure 3: Cassava Production in DRC 1991 – 2000 (mt)



In terms of geographical production levels, figure 4 below presents the data for provincial production of cassava between 1991 and 1996. Provinces that have manifested high declines in production include Bandundu and Katanga, while Oriental and Kasai have recorded some slight increases in production.

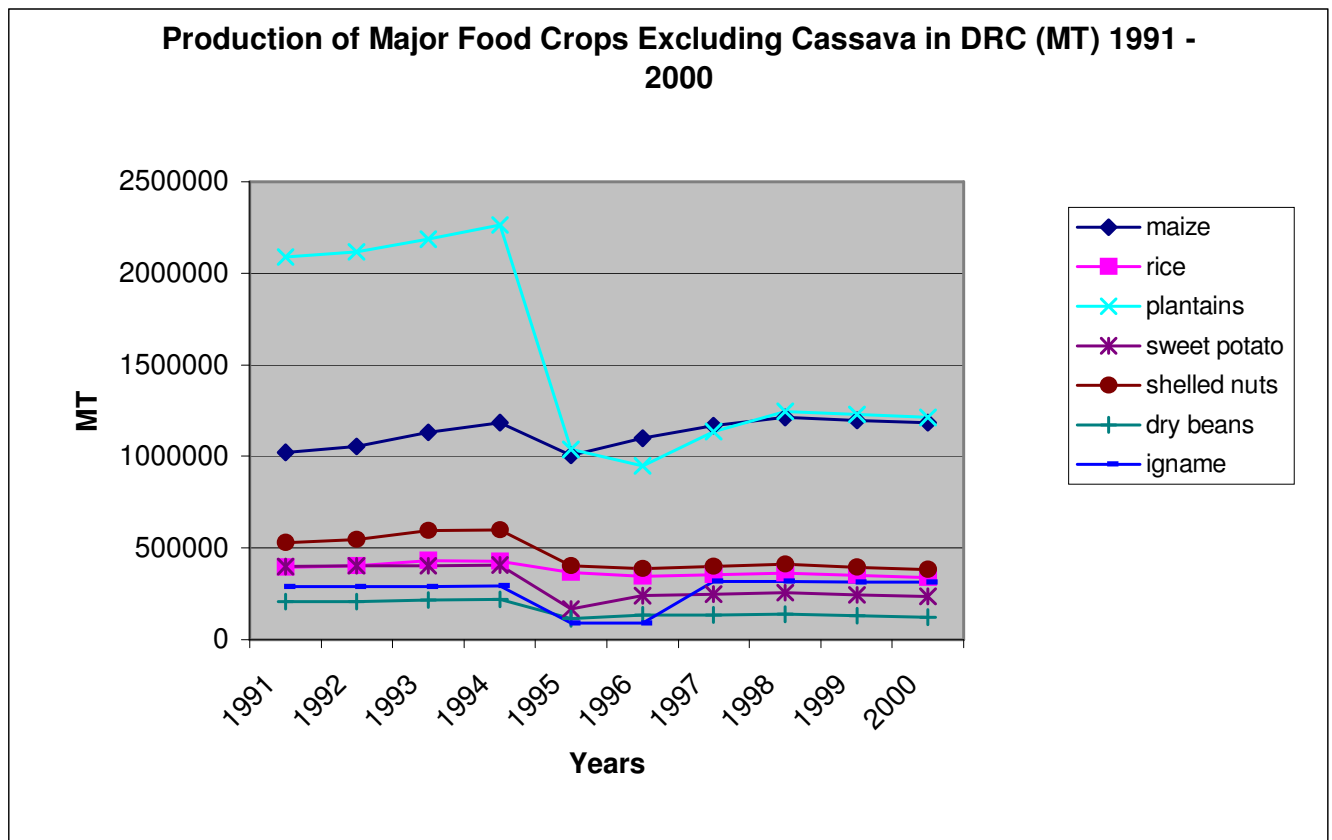
Figure 4: Provincial Production of Cassava in DRC 1991 – 1996 (mt)



The level of production of other main food-crops is presented in figure 5 below. Production levels for all the food crops show a decline between 1994 and 1995, with plantains showing the highest decline. Although the decline for most food-crops appears to stabilize after 1995, that of cassava continues (see figure 3).

The decline in food production over the years indicates the country is headed for a major food crisis. It is therefore important to ensure that measures are put in place to address the key factors leading to decline in production of the main staple foods in the country.

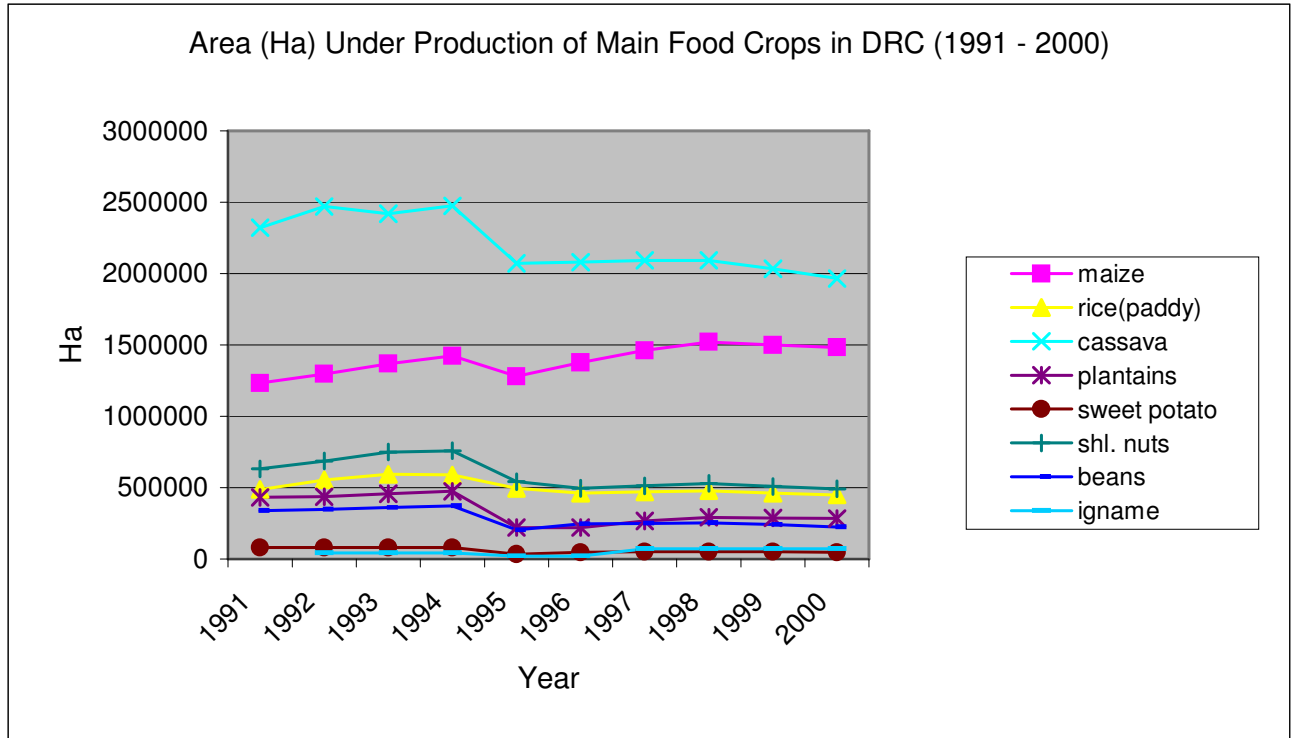
Figure 5: Production other Important Food Crops in DRC in MT (1991 – 2000)



As shown in figure 6 below the area under cassava declined in the same period, with sharpest decline happening between 1994 and 1995. This decline is also evident for other food crops for the period 1994 and 1995. Area under maize however shows a slight increase after 1995. The yields for cassava actually increased from 7,723 t/ha to 8,138 t/ha between 1994 and 1995 and therefore could not have been responsible for the decline in production.

The area under cassava appears to be decreasing while that under maize shows a steady increase. Several reasons have been advanced for this outcome by INERA research team; they include farmers substitution of cassava planting with maize in areas which have been badly affected by pests and diseases, increase in maize production due to its demand for blending with cassava in flour milling and the fact that maize can be grown in more seasons than cassava.

Figure 6: Area in Hectares Under Main Food crops in DRC (1991 – 2000)



In terms of comparison in production with other countries in the EARRNET, DRC is the undisputed major producer of cassava. While its level of production is in the neighbourhood of 20 million tons per annum, the nearest challenger is Uganda with a production estimated at about 3.4 million tons per annum. The main producing areas are the low and mid-altitude areas.

Cassava harvesting is manually done and includes mainly piecemeal harvesting which based on household food needs and market conditions including household cash requirements. Piecemeal harvesting is also practiced as method of storage. The maturing period for most of the cassava grown in the country ranges between 6 and 36 months (Nweke et al, 2000). PRONAM recommends harvesting of cassava between 12 and 18 months. About 70% of the cassava is harvested before the 12th month.

Production Constraints

Cassava production in DRC is affected by a number of factors, the leading ones being the effects of diseases and pests. The most reported diseases and pests are;

- Cassava meal bug (CMB)
- Cassava green mite (CGM)

- Africa cassava mosaic disease (ACMD)
- Cassava bacterial blight (CBB)
- Cassava root-scale (CRS)

In Kenya, where the mosaic virus is also affecting cassava production, it was found that some farmers Machakos area were not aware that the browning agent on their cassava leaves was a viral infection.

Attempts are being made by various agencies in the country to address the cassava mosaic pandemic in the country. The severity of the problem has led to formation of a cassava working group to coordinate all development activities on cassava and more importantly to help in multiplication and distribution of disease resistant varieties. This group is discussed further in the stakeholder analysis section.

Lack of clean planting material is the other main problem facing the cassava farming community in the country. The problem is compounded by the spread of the cassava mosaic disease. A number of agencies are working with farmers to address this problem. However, the limiting factor remains the limited capacity for these institutions to multiply and distribute the planting material to all the farming communities.

Low prices offered for cassava and cassava based products is also a disincentive to farmers who grow for market. Low prices are as a result of many intermediaries, poor infrastructure and low competition.

Civil strife within the country and in the region has also affected not only cassava production but production of other major food crops as well.

Lack of organized marketing system, costly transportation system and bad communication infrastructure has also affected cassava production.

MARKETING

Cassava marketing in the country takes place at different levels; farm gate, local markets, road side hawking and in major urban centers. Trade in raw roots, raw leaves, cassava chips (cossette), cassava flour, and chikwangwe is the most common especially in main urban areas. Other marketed products include; gari, boiled/roasted roots, and cassava paste which is used in making chikwangwe and other products. Gari for example is important in Bas-Congo and it has a niche market.

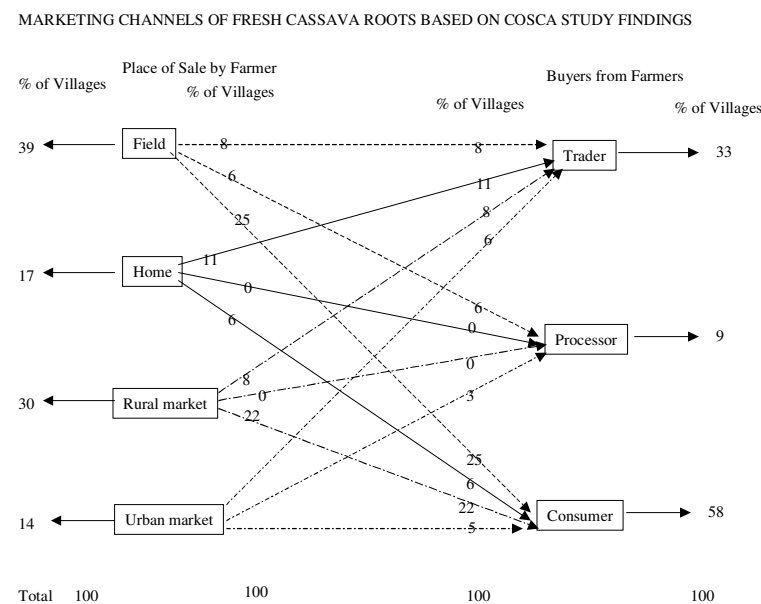
The COSCA study concludes that producers' market incentive were low because of difficult market access conditions and because of easy consumer access to imported rice and wheat bread around market centers. Easy access to rice and wheat products discourage farmers around market centers from investing in use of purchased inputs in cassava production (Nweke, et al, 2000).

Other findings were that cassava more important where middle men (traders and processors) provided marketing services than where farmers sold directly to consumers. This indicates a potential niche to promote a marketing activity for cassava. It has also been claimed that some middlemen process and export cassava leaves to European markets.

The pricing and transport elements of the cassava trade are not documented, but with the vast area of the country, transport is likely to be a major handicap to cassava trade. In other areas the bulkness of the raw roots and poor transport infrastructure coupled with poor marketing system have been blamed for low cassava prices and poor market accessibility.

Lack of price and market information is also a limiting factor to cassava production especially where production decisions are influenced by market access.

Fig. 7 Marketing Flow of Fresh Cassava Roots



The COSCA study found that about 40% of the survey villages sold cassava in the field before harvest, over 15% sold cassava after harvest at farm gate, 30% sold in rural markets and another 15% sold in urban markets. In an earlier study (Tollens, 1992) found that in Bas-Congo the main source of cassava for Kinshasa, 42% of the transactions were made at farm gate, 20% occurred at the rural markets, 14% were made directly in urban centers while 17% of the sales were made while the cassava was still in the field and the remainder sold along the roads.

Marketing Chain for Chikwangwe, Cossette and Raw Cassava Roots

In figures ...*figures have been removed*.. below we show the marketing channels for three main cassava products in the country, cossette, chikwnagwe and raw cassava roots. This information is based on discussions with key stakeholders and PRONAM researchers in Kinshasa. The margin levels or intensity of competition at each stage of the marketing chain was not revealed. The COSCA studies do not provide the margins for any of the transaction stages either.

Marketing Constraints

Marketing constraints in the cassava sub-sector are numerous and depend on the product. The main ones include;

- Low competition in the cassava trade resulting in cartel type of trade which is exploitative to farmers,
- Poor or lack of storage facilities for different cassava products, leading to high waste and poor quality products,
- Lack of market facilities (stalls, stores, etc), where traders can transact business,
- Poor transport infrastructure and facilities,
- Low prices offered to producers leading to disincentive to produce,
- Poor / lack of appropriate packaging technology, leading to low demand, poor presentation, low prices and spoilage.
- Lack of credit facilities to stimulate trade in large volumes,
- Lack of price and market information nationally and internationally for different cassava products,
- Low or no industrial utilization of cassava in different industrial uses,
- Lack of entrepreneurial skills among existing and potential cassava traders.

PROCESSING

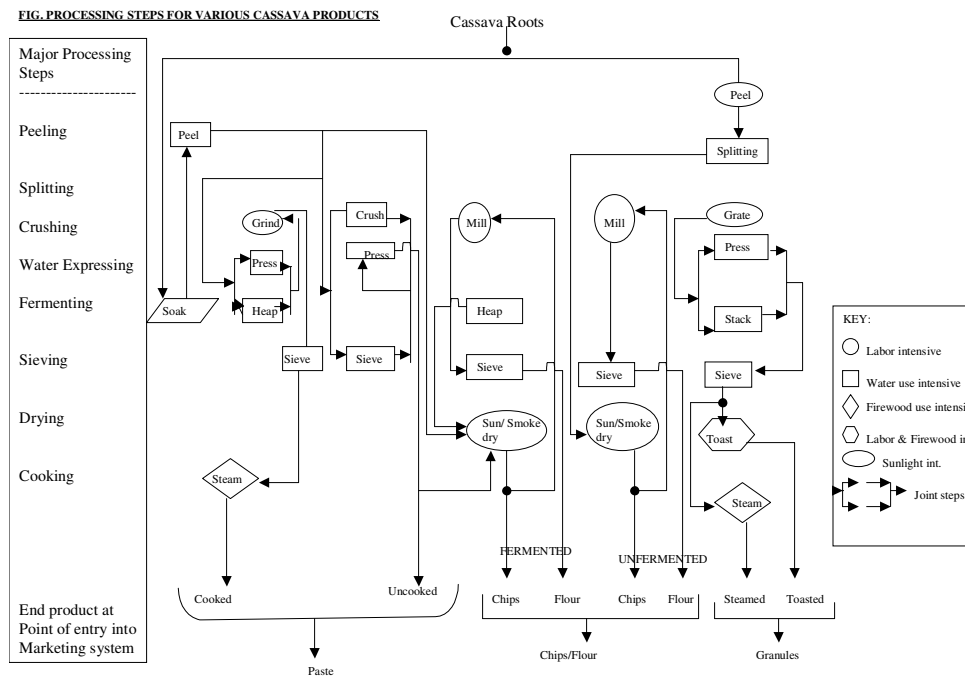
Most of the cassava processing is household based especially that of making chikwangwe and cossette. Large scale milling of cassava flour is done in Kinshasa. Other processed products in the country include paste and gari

Traditional methods used in the processing are costly in terms of labour use as well as waste. The processing methods used involve; peeling, chipping, milling, slicing or grating, dehydration by pressing, decanting, sun or smoke drying, or frying, fermentation by soaking in water, heaping, stacking, or sedimentation, sieving; and or cooking, boiling, or steaming (Nweke et al, 2000). The number of steps used and the sequencing vary depending on the product being processed. The steps are however all labour intensive. In figure 8 below the different steps and resulting products are presented in

diagram form. As it can be seen most of the steps are water and labour intensive. Making of chips and flour is also labour, water and sun/ smoke drying intensive.

The proportion of processed products was influenced by access to market services. Higher proportion of processing was observed in villages where market access was limited. Water and firewood availability determined the type of product made but did not influence the volume of processed products. In Nweke (1998), it is show that processing is essentially a female affair in about 90% of the surveyed villages, in 8% by males and females and by males only in only 2% of the representative villages.

Figure 8 Processing Steps for Various Products Made From Cassava Roots



Mechanizing peeling of the cassava is complicated by the fact that the root shapes are different and also differ in size. The level of moisture content is also of concern especially in processing of cossette. There appears to be an opportunity to develop genotypes with low moisture content for communities where cossette is the main product.

Cassava widely processed into two major products:

- Chikwangwe (ready to eat food) and
- Cossette (requires further processing and elaborate cooking at home).

Cossette is made using a wide range of traditional methods. Soaked roots can be converted into chips by sun drying or smoke drying either directly after peeling or after crushing, sieving, pressing, and rolling into balls. Other methods of making chips

directly from fresh roots include; sun dry/ smoke dry peeled fresh roots or ferment by heaping, followed by sun/smoke drying.

Cossette is the most popular form of cassava processing in the country.

Chikwangwe (paste) is made by immersing whole roots of cassava in water (streams, puddles, or in container) for three to five days to soften and ferment. The roots are then taken out of the water and peeled. Fibres are removed from the pulp by sieving in water using a basket, fibre bag, or perforated metal bowl. Chikwangwe is made mainly in the remote rural areas. Labour saving methods are not in use and the process takes a long time and is highly labourious.

Mechanization of cassava processing in the country may stimulate increased production of cassava as it has done in West African countries.

Cassava leaves are also processed for export, but the nature and level of processing and packaging is not documented.

Constraints in Processing

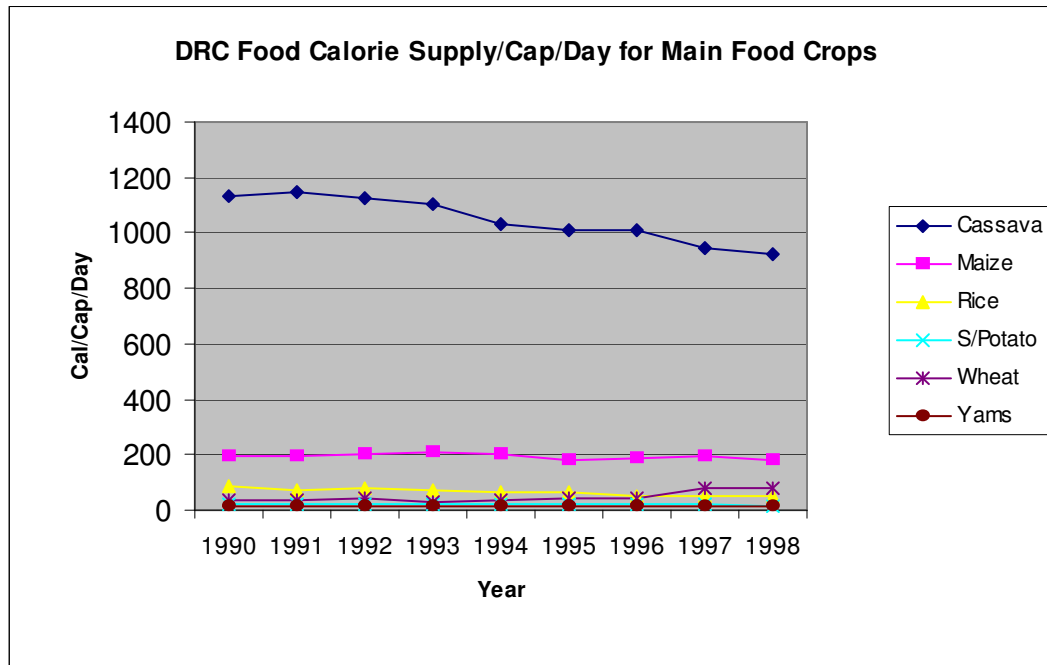
- Lack of appropriate processing technologies,
- Limited knowledge on range of potential products that can be processed from cassava,
- Lack of appropriate packaging technologies for processed products,
- Limited shelf life for some of the processed products,
- Lack of appropriate storage facilities for processed and raw materials,
- Lack of standardized cassava roots for processing,
- Limited potential market information for different processed products

UTILIZATION

Cassava in DRC is mainly used for human consumption. Both roots and the leaves are used. In some areas the leaves are more important than the roots. The sweet type of cassava is mainly eaten fresh or boiled. Bitter type of cassava is estimated at 60% of cassava production and requires more rigorous processing before eating. COSCA report (Nweke, 2000) found that 85% of cassava was utilized in processed form while 15% was used in its fresh form. Combined COSCA studies however found that the proportion of processed cassava was lower for villages that had market access (close to markets or access to services of marketing middlemen)

Cassava contributes a disproportionate large amount of (almost 60% of average daily dietary energy intake per person in DRC, maize is second largest source with just about 5% (FAO, 1970: from Nweke, et al, 2000, see also figure ... below). This share has however, continued to fall since 1991 as a result of falling production of cassava.

Figure 9. DRC Food Calorie Supply/Cap/Day for Main Food Crops



Cassava is processed into two main products in DRC, Cossette and Chikwangwe. Chikwanwe is a ready to eat product and is sold in most urban centers along the street by hawkers. Cossettes are milled into flour which is to cook a thick paste called *fufu* in local language.

The leaves are used as vegetables across the country. Cassava vegetables are also part of the recipes in low to medium class hotel menus. It has been claimed in Madagascar and DRC that farmers prefer mosaic infected leaves for vegetables and this is perceived to be a problem in transfer of virus resistant varieties. This is an area that needs to be investigated to establish the relation between leaf harvesting and root yields and also perception of farmers on leaf preference vis a vis virus resistant varieties.

In some communities across the EARRNET region, the level of knowledge of nutritional value of cassava products is largely unknown. Even among nutritional programmes in some countries cassava is said to be of low or no significant nutritional value. In tables 3 and 4 below information on nutritional value of cassava is presented.

Table 3 Protein and energy contents of cassava products prepared traditionally.*

	Raw peeled tuber	Tuber cooked in water	Peeled cooked and washed
Calories	395	394	395
Proteins	1.51	1.49	1.95

Note: * Per 100g dry matter

Source: Favier, J.C et al. 1971 "La technologie traditionnelle du manioc au Cameroun: influence sur la valeur nutritive" in Wambugu and Mungai, 2000.

Table 4 Proximate composition of cassava leaves per 100g edible portion, fresh weight.

Component	Reference	Calories	Moisture %	Protein g	Fat g	Total carbohydrate g	Fibre g	Ash G
Cassava leaf, raw	A	91	71.7	7.0	1.0	18.3	4.0	2.0
	B	60	81.0	6.9	1.3	9.2	2.1	1.6

Source: a: Food Composition Table for Use in Africa. FAO and US Dept. of Health Education and Welfare, 1968.

b: Food Composition Table for Use in Africa. FAO and US Dept. of Health Education and Welfare, 1972. in Wambugu and Mungai, 2000.

Potential Areas for Cassava Utilization

It is common knowledge that cassava processing is a tedious and labourious process and with decreasing rural labour availability most housewives would not find sufficient time to process cassava. Efforts should therefore be made to get the food processing industry such as flour millers to get involved in the cassava processing and make cassava flour and other products available in supermarkets and retail outlets in ready to cook form.

In the area of packaging, more attractive and shelf life enhancing technologies need to be developed/ identified. This will make cassava available to more people and for longer seasons in the year.

In the area of post harvest technologies a lot still remains to be done to identify appropriate storage and processing technologies, that have low losses, improve the shelf life of the commodity and guarantee quality product. Existing storage and processing technologies are wasteful and costly.

Industrial Uses of Cassava

Cassava has wide range of industrial uses that can be exploited to support a number of industrial raw material requirements of the domestic industries. The Cassava starch is an important industrial raw material. It is used in the food industry in many preparations including; sauces, gravies, custard powders, baby foods, tapioca products, glucose, confectionery and bakery products.

It is also used as a jelly or thickening agent, in manufacture of adhesives, dextrin's and pastes, used as a filler in manufacture of paints, used in textile industry and can also be used in manufacture of alcohol.

Cassava can be used in the animal feeds manufacture in the country and can be an important raw material for the expanding cattle and poultry feeds industry.

STAKEHOLDER ANALYSIS

Cassava being the most important food crop in DRC has attracted a number of development and relief agencies in the country. Following an outbreak of the cassava mosaic disease in the country, FAO formed a cassava working group in June 2000 (Ad Spijkers, July 2000). The group includes stakeholders on cassava research and development agencies (INERA, Ministry of Agriculture, EU, Belgian Cooperation, International and National NGOs and FAO). Its mission is to consult on national cassava strategy in a practical national vision that could be translated into plans and actions to safeguard and promote cassava production.

Contacts have also been established between INERA, FAO and IITA since March 2000.

INERA as the leading agriculture research institute carries the mandate of biological, biophysical, socio-economic, and post-harvest research in the country. Its cassava research programme is supported by a number of agencies. It boasts of research fields, laboratories and libraries although at the moment they lack links with other important sources of scientific information.

IITA/EARRNET have assisted the national research programme, through training of local staff to boost the INERA human capacity, IITA has also given technical support through visits. It has also given a number of its elite germplasm material for tests and eventual adoption in the country.

FAO has a food emergency project which has also identified cassava mosaic as a major problem in the country and has initiated the cassava working group to tackle the problem in a collaborative manner and to ensure farmers have access to clean planting material. FAO has started some programmes to address the cassava production constraints. The overriding concern is the effect of the cassava mosaic disease to this important food crop in DRC. Good agronomic practices are also a concern to FAO. It is promoting Integrated Pest Management practices (IPM) to counter the effects of some of the diseases and pest effects on cassava.

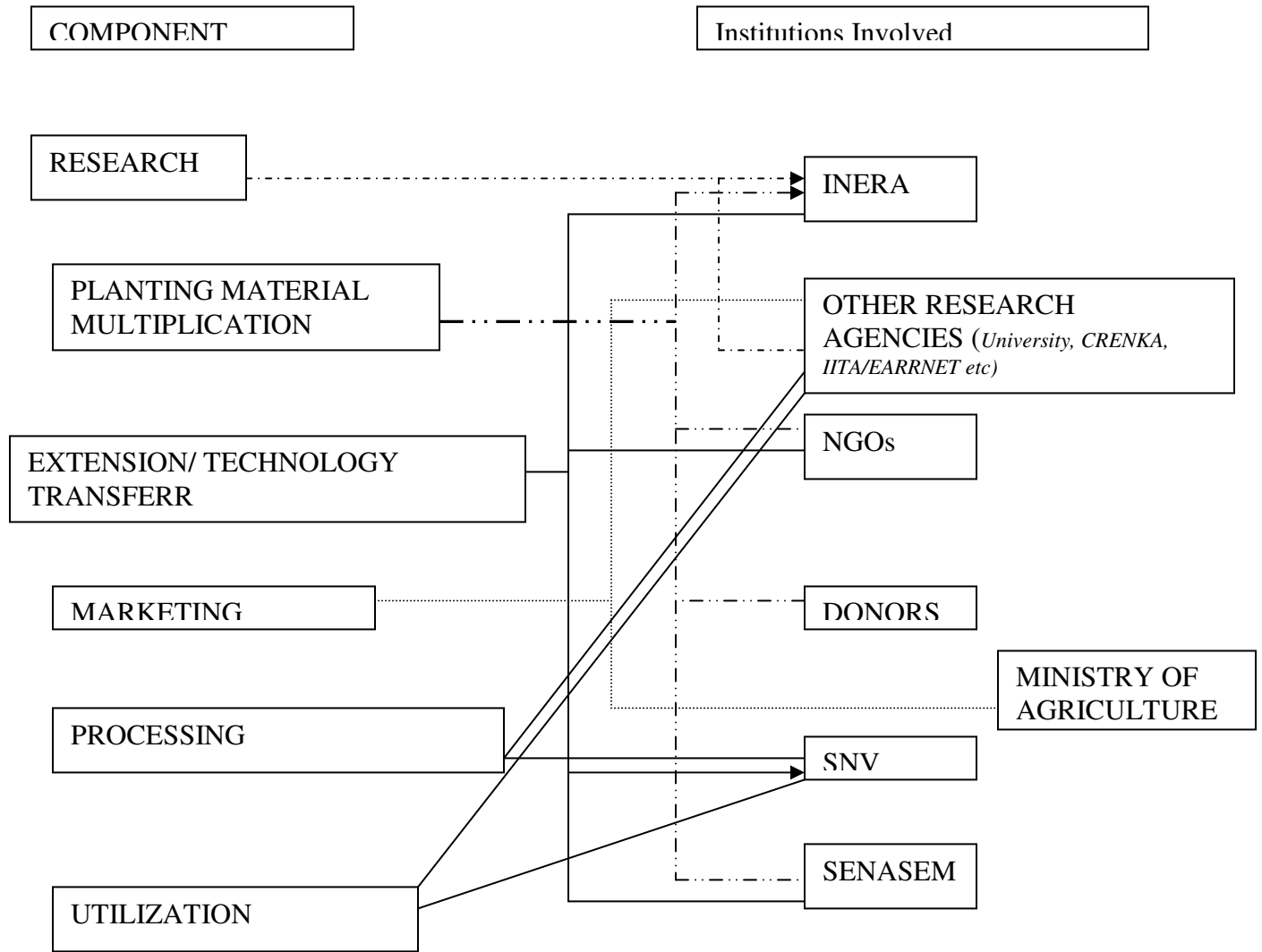
A number of organizations have shown interest in the cassava sub-sector in DRC, these include IITA, USAID (funded activities in the past though this funding has been discontinued), GTZ, and a number of NGOs led by CADIM and FOLECO. USAID is already showing interest in funding seed multiplication for cassava.

FAO has started cassava multiplication projects in the country to help farmers in getting clean planting material. There are now about 200,000 planting materials set up in nurseries. FAO is also promoting the Farmer Training School Model (FTS) for training farmers in the pest and diseases management.

The EU, Belgium Cooperation Agency and a number of other development agencies have expressed support for tackling the problems facing the cassava sub-sector through financial and technical injections.

Other important stakeholders in the cassava sub-sector in the country include; NGOs (CADIM, FOLECO, Red Cross and APPRODEC). Most of the NGOs are involved in multiplication and distribution of planting material. In figure 10 below actors within each of the components of the cassava sub-sector in DRC are presented. Although the level of involvement of various stakeholders in some of the components is high, it does not necessarily mean they are collaborating with each other.

Fig 10 Stakeholder Participation In Various Components of the Cassava Sub-sector In DRC



POLICY ENVIRONMENT

Research activities on cassava in the country were started in 1930s, under l'Institut National pour l'Etude Agronomique du Congo Belge (INEAC) at the Yangamba station. In 1974 the government created the National Cassava research Programm (PRONAM). Since 1990, the programme has benefited from technical assistance from IITA. In 1993, the programme was integrated into the national research programme l'NERA.

The objectives of the programme are to;

- Develop improved cassava varieties, that have high yields, are resistant to pests and diseases and adoptable to different ecological zones and processing,
- Develop systems for economic exploitation of cassava products, and
- Transfer of improved technologies to beneficiaries.

Cassava research is ranked very highly by the l'NERA research organization.

Cassava features prominently in the food security framework by the government and other relief agencies in the country. In this area emphasis is laid on ensuring farmers get clean planting material.

Under the technology transfer, the government's extension department SNV, plays a major role of linking research activities to the grassroot beneficiaries. The NGO community also plays an important role in transfer of improved cassava technologies.

The donor and development community in DRC are also making efforts to improve production of cassava. FAO has taken the initiative to organize a cassava working group comprising a number of key stakeholders and potential donors for the development of the cassava sub-sector. At the moment a major focus is on the planting material multiplication and distribution.

At the moment the country does not a clear policy on the development of the sub-sector. It is important that the country develops a policy that stipulates the development of the sub-sector. This will guide potential donors in funding specific activities for the sub-sector. From the information presented in this report, cassava can be promoted first to address food security issues as a large number of the population is threatened with food insecurity due to internal displacements. Data from FAO/WFP indicate substantial deficits for all main food crops including roots and tubers.

Cassava being a low input crop which can also do well with little management and is not very demanding in soil fertility and moisture like other main food crops can be given a priority for development in the country.

In terms of the crops contribution to incomes and employment, there is already substantial trade in the crop either in its raw form or in processed products. It appears that then there is potential to promote the crop not only for food security reasons but for commercial purposes as well. Commercialisation of the crop will encourage farmers to increase production either through increase in acreage or in yields by adopting better farming practices.

In order to achieve commercialisation of the crop the milliant of problems faced by processors and traders of the commodity have to be addressed. Deliberate efforts to improve on the quality and quantity of processed products will increase its income generation to traders and processors.

Technology Environment

The level technological development for any commodity sub-sector is very important and especially for commodities in which processing and marketing are important components. In the cassava sub-sector, technology issues are important in the area of planting material (types: resistant to diseases and pests, of good storage quality, ideal for processing in desired products, taste, dry matter content and suitability to different ecological zones). I'NERA's PRONAM programme in partnership with other international agencies is the leading institution in development of appropriate production technologies. IITA, has in particular played a crucial role in assisting PRONAM develop appropriated cassava cultivars.

Post-harvest technologies; methods of transportation, packaging, storage and processing are also of importance. Here again one would be interested in availability of different types of technologies, their efficiency, appropriateness and availability of spares parts and technical backup.

In DRC, like in many other African countries, availability of appropriate planting material has been a major problem affecting cassava production. Although for example the cassava mosaic disease has been around for quite sometime, availability of resistant materials is still a big constraint to many farmers. Varieties of other important traits such as dry matter content, good processing qualities are also a problem. Even where good materials exist, the multiplication and distribution system remains wanting.

In the area of post harvest and processing, technology levels remain largely traditional with inherent inefficiency, wastage and lacking in quality control. Most of the technologies are time consuming, lack economies of scale and result in unstandardized low shelf life products.

The main technology constraint areas include; storage, processing and packaging. Cassava farmers have had to do with innovative ways of addressing the technology

limitations such as underground storage, and delayed/ piecemeal harvesting. Sun drying is also largely used in cossette processing, but it is a difficult task in wet areas.

INERA in collaboration with IITA, the University of Kinshasa and CRENK are working in the area of post harvest technologies, to diversify the range of processed products and to improve on the processing technologies for current products such as flour and Chikwngwe.

PART II SURVEY RESULTS

Methodology

The cassava sub-sector analysis study was initiated in 2000 in six EARRNET countries. Each of the countries formed a task force to coordinate the national data collection and stakeholders consultations.

In October 2000, detailed literature review was started for all the six countries the review was complemented with information from stakeholders' consultations. The review was aimed at understanding the current status of the sub-sector in each country and to elicit debate on the potential areas for further investigations, research and investments targeting, institutional, policy and technological studies.

All the six EARRNET countries formed task forces comprising people working in the cassava sub-sector and of diverse disciplines.

The task forces were responsible for gathering as much literature as possible on cassava and related commodities in their country. This information was made available to the consultant for review and drafting of a status report. The draft status reports were debated national stakeholders workshops in which information gaps, areas with immediate opportunities and constraints were identified.

Field surveys were conducted in five of the six EARRNET countries to collect information for filling information gaps or updating the existing information.

Key stakeholders were consulted and their views considered in the draft country reports. The draft reports were presented at stakeholders meetings for discussions and identification of information gaps. The stakeholders made recommendations for further information collection which were considered in designing questionnaires for collection of primary data.

In DRC 161 farmers were interviewed in three provinces (Bas Congo, Kinshasa, and Bandundu). The distribution of the farm households interviewed in each province was based on weighted scale of the level of production in the province compared to other provinces.

Random sampling procedures using transect walks were applied in the smallest sampling units in each province, the cellule.

In the case of cassava traders, processors and transporters, purposive sampling procedures were applied in which key informants were used to guide researchers to main traders, processors and transporters of cassava commodities. In the case of small scale traders random sampling was applied in main trading centres.

Field Data Collection

Field surveys have been completed in five countries. Only Uganda in which a limited and focussed studies were recommended is yet to complete their studies.

Kenya has collected data on production, marketing and processing. Specific papers have also been commissioned to look at the potential niches for the sub-sector. These include; animal feeds industry, cassava in the food systems, and potential commercialisation of cassava planting material. FoodNet has also funded a study on potential use of cassava starch in Kenya. This study will be completed by the end of the year.

Rwanda: Rwanda has completed survey on production, processing and utilisation. There has been no offer for researchers to undertake any of the proposed papers for commissioning.

Burundi: Burundi has undertaken survey on production, marketing, processing and transportation. No commissioned papers have been undertaken in the country.

DRC: In DRC where cassava is the most important food crop field work focused on all areas of the crop; production, marketing, utilisation, processing, transportation and middlemen who offer support services. A commissioned paper on marketing and utilisation of cassava leaves is also being written.

Madagascar: In Madagascar thorough research work has been undertaken on all aspects of cassava; production, marketing and utilization, processing, CBOs working on cassava related projects. FoodNet is undertaking a detailed study on cassava marketing and industrial utilization.

Uganda: Uganda has had a number of studies on the cassava sub-sector including COSCA and some specific studies conducted by FoodNet. These studies have generated important information in understanding the sub-sector. After review of the available information and discussions at a stakeholders workshop in April areas that required further investigations were;

RESULTS AND DISCUSSIONS

Production

The survey was carried out in three main provinces in the western part of the country, namely Bandundu, Bas-Congo and Kinshasa. It covered 161 households as follows, Bandundu 70, Bas-Congo 63 and Kinshasa 28. In selecting the survey areas, the team considered security, high cassava producing areas and also the available resources for conducting the survey.

Cassava is the most important food crop in DRC. It is either grown as a mono-crop or intercropped with maize and groundnuts. The average cropped area was 2.98 ha of which the average cassava cropped area was 1.92 ha. The survey results show that more than 65% of the cropped area was under cassava.

The average output for the farmers interviewed for the year 2000 was 2.125 tons. Given an average price of **Fc 1000 per kilo of fresh cassava, this translates to Fc 2,125 million per farming household.**

Farming Systems

Most of the respondents reported that they grew cassava under mixed cropping although there was also a high percent of mono cropping. Only 6.8% of the respondents reported that they grew cassava under mono-cropping. while 88.2% grew under mixed cropping.

The main crop intercropped with cassava was groundnuts. Cassava was also intercropped with beans, bananas, plantains.

The most important cassava varieties grown in the surveyed areas were; F100, Kinkongolo, Mankanu, Mvuama and Muzesu. In terms of regional importance, Muzesu, F100 and Ntiti were most popular in Bandundu, Kinkongolo, Madelene, Nsubakani and F100 were most popular in Bas-Congo, and Mankanu, Mundjoko, 2864 and Jaune were most popular in Kinshasa province. Farmers reasons for preferring certain varieties were based on; yield 29%, taste 2.5%, dry matter 2.5% and early maturing 1.2%. This means that yield levels were the single most important factor influencing farmers choice for cassava varieties.

In terms of sources of the planting material farmers identified the following as the main sources; own farms (47%), other farmers (36%), and markets (2.5%). The rest were from a combination of different sources.

Table 5 Main Varieties Grown Per Country

Country	Variety No.1	Variety No.2	Variety No. 3	Variety No. 4	Variety No.5
Burundi	Nakarasi	Bitamisi	Yongwe	Inagitembe	Imiduga
Rwanda	Gitamisi	Imiribua	Gashashari	Nairo	
Kenya	Kibandameno	Sudhe	Binit-Adhumani	Obarodak	Kitwa
Madagascar	Kelimanatody	Meta	Pamba	Madarasy	Telovolana
Uganda					
DRC	F100	Kinkongolo	Muzesu	Mvuama	Mankanu

Table 6 Cropping System

Country	Cassava Grown with	% of mono-cropping of cassava
Burundi	Maize, beans, banana,	33%
Kenya	Maize, beans	24.7%
Rwanda	Maize, banana	48%
DRC	Maize, g/ nuts	6.8%
Madagascar	Maize, beans, g/nuts	56.2%
Uganda	Maize, beans	

Table 7 Cropping System By Province

Province	Cassava Grown with	% of mono-cropping of cassava	Source of Planting Material		
			Own farm	O-farmers	Extension
Bandundu	Maize, groundnuts	5.7%	45.7%	25.7%	17.1%
Bas-Congo	Maize, groundnuts	6.3%	38.1%	31.7%	19%
Kinshasa	Maize	21.4%	39.3%	35.7%	17.8%

Note: Extension includes Ministry of Agr., Research and NGOs

Table 8 Main Sources of planting Material

Country	% From The Source			
	Own Farm	Other Farmers	Market	
Kenya	24	49.4	1.6	
Burundi	60.6	6.4	0.4	
Rwanda	30.4	15.5	(combination>9.5)	
DRC	47	36	2.5	
Madagascar	69.5	26.5	0.4	

The use of improved planting material was constraint by lack of appropriate multiplication and distribution network. Only 14.2% of those interviewed reported using improved planting material. The rest were using mainly traditional materials.

When asked the reasons for abandoning certain cassava varieties, the farmers mentioned the following, low yields (20.4%), susceptible to diseases and pests (6.2%) and lack of planting material (4.9%). The most abandoned variety in all the provinces surveyed was the F100. Others were Kidamu and mpelologo (Bas-Congo), and Munene and Kidamu (Kinshasa).

Main Constraints

The main constraints faced by cassava farmers are, diseases, lack of mechanization for land preparation, labour, low yields and lack of planting material. Farmers also mentioned lack of improved planting material as another problem facing them.

In the area of diseases and pests the specific diseases and pests facing farmers were;

- **Disease:** The most virulent are CMD (52.2%), CBB-cassava bacterial blight (15.5%), root rot (14.9%)
- **Pests** included Cassava mealy bug-CMB (60.9%), CGM-cassava green mite (14.3%), CRM-cassava root scale (CRM).

Opportunities

Cassava in DRC has opportunity for being promoted to address food security. This could be achieved through addressing some of the problems identified in this study such as adoption of disease and pest resistant varieties, which INERA can acquire through its EARRNET links.

Lack of planting material can also be addressed by getting NGOs and other community based organisations and extension staff to improve on multiplication and distribution of the planting material. There is also need to identify a more sustainable method of multiplication and distribution of planting material in the country.

Trade in cassava leaves which extends beyond the countries borders should be boosted by supporting those involved in the trade to improve on processing, packaging and market expansion.

The use of cassava in the industrial sector such as in bread and biscuits should also be explored and promoted. INERA's Mvuazi station has a cassava/wheat composite flour bread making project. This should be expanded and the private sector brought into the fold to do joint research so as to ensure faster adaptation.

PROCESSING

Twenty nine (29) processors were interviewed in the following centers; 15 in Bas-Congo, 13 in Kinshasa and 1 (one) in Bandundu. Majority started in late 1990s and only three were of 1985 or older. These are very small with a labourforce ranging between 2 and 8. Most of the operations employed unskilled labourforce. Majority of the interviewed processors were operating fairly new operations with majority having started operating in 1998 or later. They therefore did not have a lot of business experience. Even then about 28% of those interviewed had had a closure of their operations for various reasons.

Main Processed Products

The main processed products were cossettes (dried chips), flour, cassava leaves and chikwangu. Processing of cassava flour was mainly using electric powered mills. Chikwangu was mainly processed using traditional fermentation and cooking process. The processors were operating on a very small scale with majority having only one or two employees.

Consumer Preference for Processed Products

The main factor influencing consumers preference for cassava flour or chips was colour. The processors said that their clients preferred snow white colour for flour or chips. The other preferences were flour texture and size of the chips.

In other countries consideration of moisture content and smell was also reported as a factor.

The principle suppliers of the raw materials for processing were

Constraints in The Cassava Processing

Constraints Facing Cassava Processors:

- Lack of raw material (primarily cassava chips)
- Poor quality of cassava chips especially during the wet season caused by inadequate drying.
- Lack of appropriate storage facilities for cassava chips and flour
- Electric power outages

Lack of cassava chips is especially severe during the wet season and processors have to stock sufficient quantities to meet monthly demands from consumers. Demand is usually very high at the end of the month. Traders' lacks appropriate storage facilities and therefore incur expenses through spoilage.

Opportunities

The potential to increase the level of micro processing of cassava exists in DRC. This can be achieved through improving access by processors to quality cassava chips. The processing technologies should also be improved so as to improve the quality of processed products to meet consumer preferences and demand. The use of cassava in bread making should be tried at the commercial level.

There is also need to expand (diversify) the range of cassava processed products to keep with changing eating habits associated with urbanization.

Processing at Household Level

At the household level simple technologies are used in processing of cassava into various products. Kitchen knives are used in peeling and splitting, while mats were used for drying purposes. Mills were used in milling the cassava chips into flour. Mortar and Paste is also used especially in making chikwangue. Most people reported using baskets for fermentation. The cassava would be wrapped with banana leaves or tarpaulins and placed into baskets for fermenting.

CASSAVA MARKETING IN DRC

95 traders were interviewed in the following areas: Bas-Congo 47, Kinshasa 40 and Bandundu 8.

The principle clients direct consumers (50.5%), combination of consumers and retailers (12.6%) and combination of consumers and wholesalers (9.5%).

Of the traders interviewed 23.2% were selling chikwangue, 24.2% flour, 16.8% leaves and 14.7% chips. 68.4% operated cassava as the sole business.

Majority of the traders were retail traders (51.4% of the respondents). Those operating purely on wholesale business were 11.4%, the rest were operating a combination of retail and wholesale business. In terms of ownership 84.2% of the respondents were the owners of the businesses, while 11.6 % were either employed or relatives of the business owners.

In terms of gender 82.1% of the traders were women and 16.8% were male.

Majority (68.4%) of those interviewed were operating cassava trade as the sole business, the others combined cassava trade with other commodities.

Traders reported the main preferences of their clients as follows; whiteness of the flour or chips (65.5%), flour texture (fineness) 3.4% and size of the cassava chips (6.9%). This implies that the most important consideration for the quality of cassava chips or flour is colour. To achieve this good colour there is need for stringent processing measures including the drying process. This will ensure the end product has the colour qualities desired by consumers. For the flour, moisture content was also mentioned as a factor influencing consumer choice.

Chikwangue consumers preferred white colour and elasticity of the product. For cassava leaves the main quality parameters were colour (green colour most preferred), and size of the bunches.

The principle suppliers to traders by gender were women as sole suppliers (34.7%), men as sole suppliers (7.4%) and a combination of men and women as suppliers (49.5%). This means that women play an important role in cassava trade in the country. Women also constituted the highest number of clients to the traders with 35.8% of the traders reporting women as their sole clients, while only 3.2% reported men as their sole clients.

Main constraints Facing Traders

The reported constraints by traders were;

- Poor supplies,
- High taxes,
- Price fluctuations,
- Lack of capital (credit),
- Transportation,
- High moisture content for chips and flour, and
- Lack of storage facilities.

Transportation

12 transporters were interviewed, six were interviewed in Bas-Congo, 5 in Kinshasa and 1 in Bandundu. They mainly transport cossettes, maize, beans, groundnuts, cassava, fufu, pondu and tomato.

The tonnage of the operated vehicles was between ½ ton and 20 tons. Cost of transportation was quite high as reported with one transporter saying he charged \$1000 for a distance of 372 kilometers from Luozi to Nkundi. This is expected in a country with poor infrastructure and shortage of fuel. This translates to high consumers prices at the final destination of the commodities.

Transport is also charged per unit of the commodity to be transported e.g. per bag and in consideration of the distance to be covered. The cost per bag is between 100fc and 1900fc.

UTILIZATION

Human Utilization

In DRC both cassava leaves and tubers are consumed. The leaves are usually consumed as vegetable. They are more nutritious compared to the tubers. Cassava is the most important food crop in the country in terms of volume of production and consumption.

The tubers are prepared into various forms of edible foods. Dried cassava chips are milled into flour which is used in cooking fufu. Cassava tubers are also pounded,

fermented and prepared into a paste like substance which is ready to eat called chikwangu. The leaves are cooked into vegetable stew referred locally as *pondu*. Chikwangu is very popular cassava dish especially in the urban centers.

The use of cassava leaves for human consumption in DRC is quite high as can be seen in the table above. The leaves are also a major source of income as can be seen in the table in which 51% of the surveyed households reported that they sold part of their cassava leaves. The main market center for the leaves is Kinshasa.

The leaves are transported from the rural areas to the main urban centers using pick up trucks.

Table 9 Percentage of Interviewed Household Who Consumed or Sold Cassava Leaves

Country	% of Respondents using Cassava leaves for household consumption	% Sell cassava leaves
Kenya	43.9	
Rwanda	44.6	
Burundi	91	1.5
DRC	87	51
Madagascar	88.6	51
Uganda		

Utilization of Cassava As Animal Feed

In DRC only 14.9% of the interviewed households reported that they fed cassava to their livestock. In Madagascar 44.4% of the respondents reported that they fed various forms of livestock with cassava, while in Kenya 29.2% also reported feeding cassava to livestock.

Table 10 Percentage of Interviewed Households Who Fed Cassava to Livestock

Country	% of respondents Feeding Cassava to livestock	
Kenya	29.2	
Rwanda	3.4	
Burundi	8.5	
DRC	14.9	
Madagascar	44.4	

Uganda		
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The low use of cassava for animal feeds in DRC may be explained by the fact that the country does not have a strong livestock sector. The other factor is that the country owing to its tropical climate has sufficient natural pastures for its livestock. Cassava is also grown more as a food crop than industrial or commercial crop in the country.

Industrial Utilization of Cassava

There was no evidence during this survey of industrial use of cassava in the country. However, some potential use may be found in the textile and bread and biscuits industries in the country. Another potential industrial consumer is the brewery industry, but there is no local manufacture of cassava starch which can be used in the brewery industry.

The potential use of cassava in the textile and bread and biscuits industries may be investigated through a specific study.

CONCLUSION AND RECOMMENDATIONS

Cassava remains an important food crop and source of income to many rural and urban households in DRC. Both leaves and tubers are important sources of food for majority of the people. They are also an important source of direct income to farmers, traders, transporters and input suppliers. Based on the available statistics cassava will continue to occupy the number one position in food crops in the country for the foreseeable future.

The Government and the donor agencies have recognized the importance of the sub-sector in the country and especially in relation to food security and initiated various measures to promote and sustain the sub-sector.

In the area of research INERA, through the cassava research programme (PRONAM) has played the leading role in breeding, germplasm development and agronomic research. It has worked closely with other agencies such as University of Kinshasa, SNV, CRENK, and IITA/EARRNET in the area of biological and socio-economic research and technology transfer.

Other important agencies in the development of the cassava sub-sector in the country include donors (Belgium Cooperation Agency, UNDP, FAO, and EU), NGOs (CADIM, FOLECO, Red Cross, and APPRODEC). Most of these agencies have intervened in the area of technology transfer (planting material multiplication and distribution and capacity building). Others have programmes that address community capacity in marketing and transportation of cassava products.

Whereas the cassava sub-sector plays an important role in the country, its future seems to be threatened by a number of factors, the main ones being the African Cassava Mosaic Diseases with a combination of other diseases and pests, low level of technological development and adoption in production, and processing.

FAO has initiated a cassava working group in the country with the aim of coordinating all cassava development activities in the country and addressing the most pressing needs from a common front. This group comprises the main stakeholders in the cassava sub-sector in the country and interested donors.

The efforts being made by the cassava working group in the country need to be recognized and strengthened by bringing more stakeholders into the fold and having formalized working agenda and mandate. The group should also focus on more broad issues of the sub-sector beyond the sanitary and multiplication and distribution issues emphasized at the moment.

Areas that would need attention would include strengthening INERA's capacity through training, technical assistance and resource allocation. Research into post-harvest issues focusing on broadening the range of processed and marketed products need to be undertaken. Existing processing technologies are also inefficient and need to be improved so that resulting products are made more attractive and competitive in the market.

The marketing issues raised also need to be addressed to ensure farmers get better returns for their cassava.

Specific Recommendations

Production Level

Improve Multiplication and Distribution of Farmer Preferred Varieties

Improve Dissemination of Extension Messages

Improve Linkages With Other International Agencies Such IITA, EARRNET to Tap Improved Technologies

Improve Research Funding

Post-Harvest

Improved Drying Technologies for Cassava Chips

Improve Processing Technologies for Cassava Flour to Achieve Desired Attributes

Improve Linkages Between Farmers and Processors in Urban Centres

Promote Industrial Use of Cassava Such as in Large Scale Milling, Confectionary etc.

Marketing

Establish a Market Information Service for Main Commodities Including Cassava

Need to Have Appropriate Market Infrastructure in Main Urban Centres (Space, Storage, Sanitation etc).

Utilization

Need to Diversify Consumable Cassava Products

Improve the Quality and Standardization of Existing Products Through Improved Technologies

Develop an Recipe Cassava Extension Manual for Use for Nutrition Extensionists

Policy Level

Promote Cassava for Food Security

Coordinate All Cassava Activities Among Various Institutions in The Country Through Establishment of a Cassava Working Group

Make a Deliberate Attempt to Promote Improved Processing Technologies for Cassava

Revise Punitive Taxes that Discourage Cassava Trade

Consider Availing Credit to Cassava Traders (Micro-Credit Scheme Can Be Established)

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